

WHAT IS CLAIMED IS

1. A starting apparatus of an internal combustion engine comprising: a main air passage including an intake manifold for supplying air to each cylinder of the engine, a bypass air passage provided in parallel to the main air passage and connected close to the intake port of each cylinder, a vaporization fuel supply means for supplying vaporized fuel to the bypass air passage, and a bypass air control valve capable of controlling the incoming air quantity into the bypass air passage, wherein main air control valves for the main air passage are provided near intake ports in respective pipes of the intake manifold.

2. A starting apparatus of an internal combustion engine according to claim 1, wherein at the time of start-up cranking, the bypass air control valve is opened and the main air passage is closed or throttled by the main air control valves, further vaporized fuel is supplied to the bypass air passage by the vaporization fuel supply means.

3. A starting apparatus of an internal combustion engine comprising:

a main air passage including an intake manifold for supplying air to each cylinder of the engine, a bypass air passage provided in parallel to the

main air passage and connected close to the intake port of each cylinder,

a bypass air control valve that is capable of controlling the incoming air quantity into the bypass
5 air passage and opened at the time of start-up cranking,

a vaporization fuel supply means for supplying vaporized fuel to the bypass air passage, and

fuel injection valves that are installed near respective intake ports of cylinders of the engine or
10 installed directly in respective cylinders, and inject the maximum fuel quantity of themselves available in the cranking period within a specified length of time after the beginning of start-up cranking, and then decreases the injected fuel quantity or stops injection
15 in the rest of the cranking period after injecting the maximum fuel quantity.

4. A starting apparatus of an internal combustion engine according to claim 1, wherein the vaporization fuel supply means comprises an auxiliary fuel injection
20 valve and a heater for heating the fuel injected from the auxiliary fuel injection valve.

5. A starting method of an internal combustion engine comprising: a main air passage including an intake manifold for supplying air to each cylinder of
25 the engine, fuel injection valves that are installed

near respective intake ports of cylinders of the engine
or installed directly in respective cylinders, a bypass
air passage provided in parallel to the main air passage
and connected close to the intake port of each cylinder,
5 a vaporization fuel supply means for supplying
vaporized fuel to the bypass air passage, and a bypass
air control valve capable of controlling the incoming
air quantity into the bypass air passage,

wherein at the time of start-up cranking, the bypass
10 air control valve is opened and vaporized fuel is
supplied to the bypass air passage from the
vaporization fuel supply means, and besides the fuel
injection valves inject the maximum fuel quantity of
themselves available in the cranking period within a
15 specified time after the beginning of start-up cranking,
and a time for decreasing the injected fuel quantity
or stopping the injection is set in the rest of the
cranking period after injecting the maximum fuel
quantity.

20 6. A control method of an internal combustion
engine equipped with the starting apparatus according
to claim 1, wherein the internal combustion engine is
stopped automatically when the specified idling stop
permissible conditions are satisfied, the bypass air
25 control valve is opened and the start-up cranking is

actuated when the specified engine start conditions are satisfied after the engine has stopped by satisfaction of the specified idling stop permissible conditions , and the vaporized fuel is supplied to the
5 bypass air passage from the vaporization fuel supply means during start-up cranking.

7. A control method of an internal combustion engine equipped with the starting apparatus according to claim 4, wherein the internal combustion engine is
10 stopped automatically when the specified idling stop permissible conditions are satisfied, the heater is energized for a specified time when the specified heater energization conditions are satisfied, after that, a non-inenergization period of the heater is set,
15 and also start-up cranking is actuated when the specified engine start conditions are satisfied after the internal combustion engine has stopped by the satisfaction of the idling stop permissible conditions, and vaporized fuel is supplied to the bypass air passage
20 from the vaporization fuel supply means during start-up cranking.

8. An exhaust filtration apparatus installed in an exhaust pipe of an internal combustion engine equipped with the starting apparatus according to claim
25 1, wherein the exhaust filtration apparatus comprises

a catalyst that holds no HC absorbent.

5 9. An exhaust filtration apparatus installed in
an exhaust pipe of an internal combustion engine
equipped with the starting apparatus according to claim
1, wherein the exhaust filtration apparatus has one
or more support containers on the exhaust pipe, and
the catalyst supports filled into one of the support
containers hold HC absorbents.

10 10. An exhaust filtration apparatus installed in
an exhaust pipe of an internal combustion engine
equipped with the starting apparatus according to claim
1, wherein the exhaust filtration apparatus has plural
support containers in the exhaust pipe, and the
catalyst supports filled into any one of the support
15 containers, that are located in the downstream of the
exhaust pipe compared to the support container located
in most upstream of the same, hold HC absorbents.